Title: Lollipop Lovers Delight – Integrating Science, Math and Writing

Brief Overview:

Students participate in an experiment with Tootsie Pops to determine the average number of licks it takes to reach the chocolate center in the Tootsie Pop.

They will learn how to perform the experiment using the Scientific Method, collecting and displaying data with bar graphs, analyzing and comparing results of other groups. When constructing bar graphs the students will include the necessary components and choosing an appropriate scale. As a culminating activity students will correspond with the Tootsie Pop Corporation about these results.

NCTM Content Standard/National Science Education Standard:

Data Analysis

- Formulate questions that can be addressed with data and collect,
- Organize, and display relevant data to answer them;
- Select and use appropriate statistical methods to analyze data;
- Develop and evaluate inferences and predictions that are based on data;
- Utilizing scientific inquiry skills

Grade/Level:

Fifth Grade

Duration/Length:

5-6 Days (45 minutes per lesson)

Student Outcomes:

Students will be able to:

- Perform the basic steps of the Scientific Method
- Gather data using tally marks
- Calculate the mean of group and class data
- Interpret the data for similarities and differences
- Communicate experiment results in a business letter format

Materials and Resources:

- Teacher Resources – See Appendix A
- Student Resources – See Appendix B

- Tootsie Pop for each student
- Business Envelope for each student
- Large chart paper
- Calculators (optional)
- Markers or Crayons

Lesson 1 Lollipop Lovers Delight

Pre-assessment

Begin by asking students to brainstorm the steps of the scientific method. Once the students recall the processes of the scientific method, ask students to provide more details about each process.
Teacher will use an overhead to write students' responses on the board.

Launch

Ask one final question: When conducting a fair experiment what variables should you try to control? Inform the class they will be conducting an experiment in which they must control two variables, style and location.

Teacher Facilitation

Distribute Student Resource 1 and as a group reviews the steps of the Scientific Method. Together review the steps for conducting an experiment. Distribute "Lollipop Lovers Delight" (Student Resource 2, Student Resource 3 to students. Inform students that they will be performing an experiment trying to solve the age-old secret; "How many licks does it take to reach the middle of a Tootsie Pop"? Review the variables that students must try to control.

Student Application

Students will review the Scientific Method filling in the blanks. Students will work in small groups of 4 or 5. Each group member will choose a different flavor Tootsie Pop. Presented with the situation: "How many licks will it take to reach the chocolate in the center". Students will make a prediction and record results on their worksheet (Student Resource 2). As students begin to conduct the experiment they must record the number of licks on their tally sheets. (Student Resource 3)

Embedded Assessment

Discuss how student will lick lollipop (No swirling), one place only, and no biting. Review how student will record their licks on their tally sheet.

Reteaching/Extension

- Assemble a reteach group, if necessary, and guide them through Student Resource 2. The rest of the class will work together on creating their graphs.

Lesson 2 Working the Data

Pre-assessment

Question the students as to what are the elements of a bar graph. Draw on overhead or on large sheet of paper as the students list the elements of a bar graph. *Teacher Resource 2* (*Answers should include vertical axis, horizontal axis, labels, title, zero, bars separate from each other, scale).*

Launch

Ask students how they can use their knowledge of bar graphs to display our data that they collected about the number of licks needed to reach the center of a Tootsie Roll Pop.

Teacher Facilitation

Distribute Student Resource 4 Bar Graph Sample. Have students create their own class bar graph. Be sure all elements of a bar graph are included in each student's copy. They will be using this as a reference sheet when they create their group bar graph. Observe each group for accuracy on graph.

Student Application

Students choose a group name to be included on their individual graphs. Distribute a second, blank Student Resource 4 for student to start his/her group graph. Students refer to Student Resource 2 for the actual number of licks from each student in their groups. Students find the mean (average) for their group using the formula on Student Resource 2. Students determine the scale to fit their data on the vertical axis by looking at the lowest and the highest number of licks in their group *(The data will most likely fit with increments of 10, however if the there is an outlier, the graph may need to have increments of 20 or 25)* Students complete the graph individually with group data, using a different color bar for each student in their group. Students should be reminded to leave a space between the bars.

Embedded Assessment

- Students compare their graphs with other team members. If there are any differences, review data for accuracy. Teacher visits each group to check for accuracy, answer questions, and redirect if needed.

Reteaching/Extension

- Class works as a whole group to find the total class mean (average) by using the means of the different groups to find one class mean number of licks (Extension)
- The class will combine group data to construct a class bar graph showing the mean of each group. This will help review and reinforce for those students who have not mastered the concepts of mean and bar graphs. This will give them time to readjust their individual graphs and see the relationship between their graphs and the class graph.

Lesson 3 – Writing to the Tootsie Pop People

Pre-assessment

Ask students how they should communicate the results of their experiment to the Tootsie Pop Company. (*Answers will vary and may include e-mail, calling, and write a letter.)* Take a vote as to which way of communication would be the best. Explain the purpose of a professional business letter.

Launch

Ask each student to write a friendly letter to a student in one of the other groups telling their findings from the experiment.

Teacher Facilitation

Distribute Student Resource 6 (Business Letter Format). Compare friendly letter they wrote with the sample business letter. Discuss similarities and differences (*Answers should include business address is on business letter: the author of a business letter signs and prints name, friendly letter is more casual than a business letter, etc.)*

Student Application

Have students draft letter to the Tootsie Pop Company using the proper address and business letter template. Be sure the students use the same topics outlined in the sample for each of the three good paragraphs of the letter. The draft should be double spaced for possible editing.

Embedded Assessment

Peer Edit - Exchange first draft with one partner in experiment group. Students are to read their partner's letter. Using the Peer Guide Student Resource 5, comment on incorrect spelling and grammar. Check for partner's understanding and proper business letter format in their letter.

Reteaching/Extension

- *Teacher Edit* – Determine those students who need more work on their draft and form a small group to help with paragraph formation or business letter format.
- Remaining students may begin to work up their final copy of the letter.

Summative Assessment:

Students will have selected responses and questions that assess understanding. (Student Resource 7). Answer key is on Teacher Resource 7.

Authors:

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The Scientific Method

Step 1: Purpose

Why are you doing this experiment?

Step 2: Hypothesis

What do you think will happen during this experiment?

Step 3 Materials

What materials do you need in order to do this experiment? Making *a list is usually the easiest.*

Step 4 Procedures

What steps will you follow in this experiment? *Again, a numbered, step-by-step list is usually the easiest*

Step 5 Observations

What changes occurred during the experiment? What did you see, feel, taste, smell, hear, notice, and observe?

Step 6 Conclusions

What did you learn from this experiment? How does that compare with your hypothesis**?**

Lollipop Lovers Delight

Name: _____ Date: _____

Purpose: Student will determine how many licks it takes to reach the chocolate of a lollipop.

Prediction: __ (Students predictions should provide exact number of licks they think it will take them to reach the chocolate center. Predictions should be written in the correct format. I predict it will take 200 licks to reach the chocolate center of the lollipop).

Materials: 1 Lollipop per student
Lollipop Lovers work sheet (SR1)
Tally task sheet (SR2)

Procedure:
Teacher:

1. Show a lollipop to the students. While observing the lollipops composition, orally discuss your observations. Point the roundness or lack of roundness that one side appears not to be as thick as the other side. Point the roundness of lack of roundness that one side appears not to be as thick as the other side. Deicide where to start on the lollipop based on observations.
2. Orally make a prediction on how many licks you think it will take to reach the chocolate center.
3. Begin licking lollipop, demonstrating the correct technique. NO swirling aloud.

Student:

1. Distribute lollipops,
2. **Observe** the different features in each piece.
3. Make a prediction as to how many licks it will take you to reach the chocolate center. **Record** your Prediction.
4. Invent a system for recoding the tally marks. Example: 1 tally mark equals 5 licks or 1 tally marks equals 10 licks. **Record** your licks.
5. Compare your information with that of your team members. **Record** group findings.

Data:

1. Students should make observations as to color, the size, weight, shape, unusual air holes or pockets that may have occurred _____

2. I will record one tally mark for every five licks

3. Recordings will vary based on each student's individual data

Draw Conclusions:

1. What kind of differences did you observe about your lollipop?
   Answers will vary based on student's data

2. How was your lollipop different from your team members? (size, shape, color)
   Answers will vary based on student's data

3. How was your licking style compared to your team members?
   Answers will vary based on student's data. _Examples may represent short licks or long

4. Was your prediction correct?
   Answers will vary based on student's data.

Teacher Resource 3

Lollipop Lovers Delight

Task Sheet

Student Name: _____ Date: _____

Color of Lollipop	Number of Licks (1 Tally = _____ Licks)

Group Information:

Students Name	Color of lollipop	Number of Licks

Find the Groups Average:

Add each student's total number of licks.

_____

_____

_____

_____

_____

Total + _____

Divide the total by the total number of group members:

_____ / _____ = _____

Group total (divide) Number in group Group average

Teacher Resource 4

Name: _____ Date: _____

_____(Title)

_____

Peer Editing Guide for Business Letter

Writer's Name _____ **Editor's Name** _____

Check off after looking for the following items:

1. Is the proper date in the upper, left corner? _____

2. Is the business address correct? _____

3. Is the business address next to the left margin? _____

4. Is the salutation directly after the business address? _____

5. Is the salutation formal and not casual? _____

6. Do the sentences in each paragraph include:
   a. Correct spelling? _____
   b. Are sentences in complete thoughts? _____
   c. All sentences begin with capital letter? _____
   d. All sentences end with a period, question mark, or exclamation point? _____
   e. No run on sentences? _____
   f. Commas are used properly? _____

7. Does the **opening** paragraph include an introduction and why the letter is being written? _____

8. Does the **body** paragraph include a description of the experiment? _____
   a. Use numbers and words to describe the experiment? _____
   b. Explain the class average number of licks? _____

9. Does the **concluding** paragraph include a comment, opinion, or thank-you? _____

10. Did you give the writer one compliment about their letter? _____

11. Did you give the writer at least one suggestion to improve their letter? _____

12. Did you attach this completed sheet with your rough draft? _____

Business Letter Format

Date

Tootsie Roll Industries, Inc.
Consumer Relations – Dept. 749
7401 South Cicero Avenue
Chicago, Illinois 60629-5885

Dear Consumer Relations Department,

Your first paragraph, as with all of your other paragraphs, should follow the format of a good topic sentence, 2-3 detail sentences about your topic, and a good closing sentence ending the paragraph. In the first paragraph, you should be stating what the letter is about and why you are writing to the Tootsie Pop Company. Introduce yourself, what grade and what school you attend. *(About 5 sentences)*

Your second paragraph should follow the good paragraph format and include the details of your experiment. Be sure to talk about what you did to conduct your Scientific Experiment and a description of how you did it. Explain what your group did to get the mean or average number of licks for your group and how everyone came to a class average. Be sure to use numbers and your science/math vocabulary when talking about your experiment and results. *(About 5 sentences of more)*

Your third good paragraph form should include what you enjoyed about doing the experiment, your opinion about Tootsie Pops, how the company can improve their product, and any other comments you may want to share with them. Be sure to thank them for making Tootsie Pops. *(About 4-5 sentences)*

Sincerely,

Your Signature
Your Name- Typed

Teacher Resource 7

Lollipop Lovers Delight Summative Assessment

Name: _____ Date: _____

1. A hypothesis is what part of a scientific method _____.
   * a. an educated guess based of prior knowledge
   b. the recoding of supplies used in the experiment
   c. a summary explaining your answers
   d. writing down the results

2. A conclusion is what part of a scientific method _____.
   a. an educated guess based of prior knowledge
   b. the recoding of supplies used in the experiment
   * c. a summary explaining your answers
   d. writing down the results

3. What information is needed on a bar graph?
   a. labels, title, vertical line, bars
   * b. labels, title, vertical line, horizontal line,
   c. labels, title, vertical line, average
   d. labels, title, vertical line, data

4. What two operations do you use to find the mean (average)?
   a. add and subtract
   b. add and add
   c. add and multiply
   * d. add and divide

5. What would be a correct greeting on a business letter?
   a. Hello
   * b. Dear Sir/Madame
   c. Greeting From
   d. Dear Jane or Tom

6. What parts does a business letter have that a friendly letter does NOT?
   a. Date and signature
   b. Salutations and closing
   * c. Address, printed and signed name
   d. Address and closing

Use the bar graph to answer Problems 7-10

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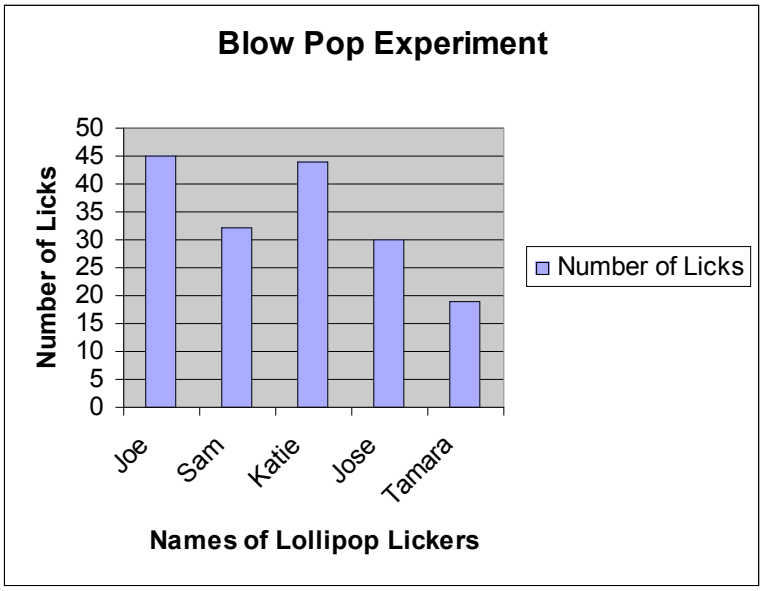

7. About how many licks did it take for boys to reach the bubble gum?
   a. 45
   b. 80
   * c. 107
   d. 97

8. Who took longer to reach the bubble gum center?
   * a. Joe
   b. Katie
   c. They both took the same number of licks
   d. Sam

9. Who has the most licks?
   a. Joe and Tamara
   * b. Sam and Katie
   c. Jose and Sam
   d. Joe and Jose

10. If it took Joe 45 licks, Sam 32 licks, Katie 44 licks, Jose 30 licks, and Tamara 19 licks. What is the average for the group?

    a. 45
    b. 43
    c. 170
    * d. 34

The Scientific Method

Step 1: Initial Observation

_____
_____
_____

Step 2: Hypothesis

_____
_____
_____

Step 3 Materials

_____
_____
_____

Step 4 Procedures

_____
_____
_____

Step 5 Observations

_____
_____
_____

Step 6 Conclusions

_____
_____
_____

Lollipop Lovers Delight

Name: _____ Date: _____

Purpose: Students will determine how many licks it takes to reach the chocolate center of a lollipop.

Prediction:

_____
_____
_____
_____
_____

Materials: 1 Lollipop per student
Scientific Method (Student Resource 1)
Lollipop Lovers work sheet (Student Resource 2)
Tally task sheet (Student Resource 3)

Procedure:

1. **Observe** the different features in your lollipop.
2. Predict the number of licks it will take to reach the chocolate center of your lollipop. **Record** your prediction.
3. Invent a system for recoding the tally marks. Example: 1 tally mark equals 5 licks or 1 tally mark equals 10 licks. **Record** your licks.
4. Compare your information with that of your team members. **Record** group findings.

Data:

2. _____
   _____
   _____
4. _____
   _____
   _____
5. _____
   _____
   _____

Draw Conclusions:

1. What kind of differences did you observe about your lollipop?

   _____
   _____
   _____

2. How was your lollipop different from your team members? (size, shape, color)

   _____
   _____
   _____

3. How was your licking style compared to your team members?

   _____
   _____
   _____

4. Was your prediction correct?

   _____
   _____
   _____

Student Resource 3

Lollipop Lovers Delight

Task Sheet

Student Name: _____ Date: _____

Color of Lollipop	**Number of Licks (1 Tally = _____ Licks)**

Group Information:

Students Name	Color of lollipop	Number of Licks

Find the Groups' Average.

Add each student's total number of licks.

_____

_____

_____

_____

_____

Total + _____

Divide the total by the total number of group members:

_____ ÷ _____ =_____

Group total (divide) Number in group Group average

Student Resource 4

Name: ____________________________ Date: _______________________________

____(title)

Student Resource 5

Peer Editing Guide for Business Letter

Writer's Name _____ Editor's Name _____

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8. Does the **body** paragraph include a description of the experiment? _____
   a. Use numbers and words to describe the experiment? _____
   b. Explain the class average number of licks? _____

9. Does the **concluding** paragraph include a comment, opinion, or thank-you? _____

10. Did you give the writer one compliment about their letter? _____

11. Did you give the writer at least one suggestion to improve their letter? _____

Student Resource 6

Business Letter Format

Date

Tootsie Roll Industries, Inc.
Consumer Relations – Dept. 749
7401 South Cicero Avenue
Chicago, Illinois 60629-5885

Dear Consumer Relations Department,

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Your third good paragraph form should include what you enjoyed about doing the experiment, your opinion about Tootsie Pops, how the company can improve their product, and any other comments you may want to share with them. Be sure to thank them for making Tootsie Pops. *(About 4-5 sentences)*

Sincerely,

Your Signature
Your Name- Typed

Student Resource 7

Lollipop Lovers Delight Summative Assessment

Name: _____ Date: _____

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    c. a summary explaining your answers
    d. writing down the results

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    b. labels, title, vertical line, horizontal line,
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    d. labels, title, vertical line, data

4. What two operations do you use to find the mean (average)?
    a. add and subtract
    b. add and add
    c. add and multiply
    d. add and divide

5. What would be a correct greeting on a business letter?
    a. Hello
    b. Dear Sir/Madame
    c. Greeting From
    d. Dear Jane or Tom

6. What parts does a business letter have that a friendly letter does NOT.
    a. Date and signature
    b. Salutations and closing
    c. Address, printed and signed name
    d. Address and closing

Use the bar graph to answer Problems 7-10

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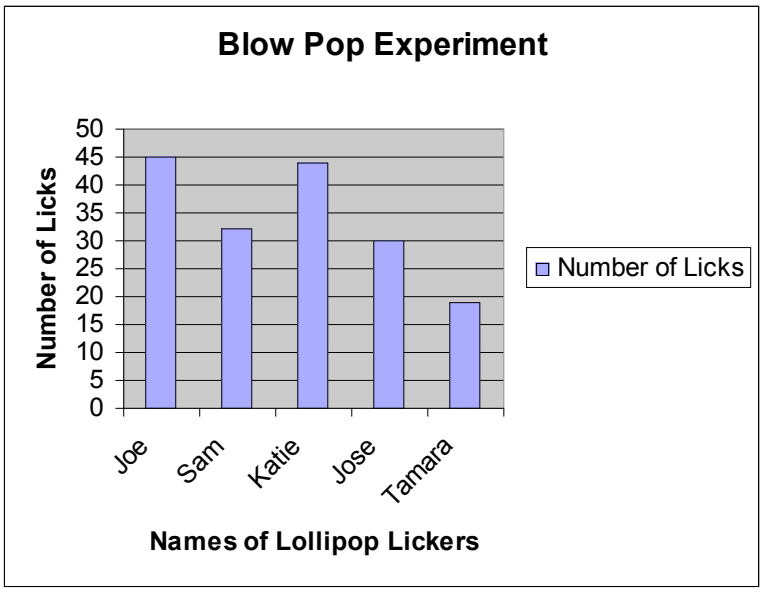

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   d. 97

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   a. Joe
   b. Katie
   c. They both took the same number of licks
   d. Sam

9. Who has the most licks?
   a. Joe and Tamara
   b. Sam and Katie
   c. Jose and Sam
   d. Joe and Jose

10. If it took Joe 45 licks, Sam 32 licks, Katie 44 licks, Jose 30 licks, and Tamara 19 licks. What is the average for the group?

    a. 45
    b. 43
    c. 170
    d. 34